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Mazdoor Kisan Shakti Sangathan

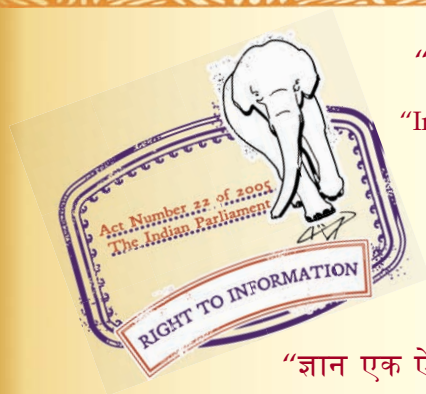
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“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 5857 (1970): Nickel and nickel alloy bare solid welding rods and electrodes [MTD 11: Welding General]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**SPECIFICATION FOR
NICKEL AND NICKEL ALLOY BARE SOLID
WELDING RODS AND ELECTRODES**

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR NICKEL AND NICKEL ALLOY BARE SOLID WELDING RODS AND ELECTRODES

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Indian Standard

SPECIFICATION FOR NICKEL AND NICKEL ALLOY BARE SOLID WELDING RODS AND ELECTRODES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 7 December 1970, after the draft finalized by the Welding General Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard is one of the series of standards covering comprehensively the requirements for the filler rods and wires for gas-shielded arc welding, and covers nickel and nickel alloys. The other standards in this series cover the filler rods and wires for inert gas welding of the following:

- a) Structural steels,
- b) Copper and copper alloys,
- c) Aluminium and aluminium alloys and magnesium alloys, and
- d) Corrosion and heat-resisting chromium-nickel steels.

0.3 The requirements for filler rods and wires suitable only for TIG welding are covered in IS: 2680-1964*. In this standard, the requirements for filler rods and wires have been covered comprehensively irrespective of the process of welding used. It is intended that with the publication of this standard, IS: 2680-1964* will be withdrawn.

0.3.1 The diameters of wires, dimensions of spools, rims and coils have been based on appropriate ISO Recommendations.

0.4 This standard keeps in view the manufacturing and trade practices being followed in the country in this field. Assistance has also been derived from the following publications:

ISO/R 546-1966 Lengths and tolerances for drawn or extruded filler rods for welding supplied in straight lengths. International Organization for Standardization.

*Specification for filler rods and wires for inert gas tungsten arc welding.

ISO/R 864-1968 Solid wires for gas-shielded metal-arc welding of mild steel. International Organization for Standardization.

Draft British Standard specification for filler rods and wires for inert-gas arc welding, Part 5 Nickel and nickel alloys. British Standards Institution.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements of bare solid filler rods and wires for welding nickel and nickel alloys by inert-gas tungsten arc welding (TIG) or gas metal arc welding (MIG). The chemical composition of filler rods is also specified.

1.1.1 This standard does not specify the chemical composition and the mechanical properties of the weld deposit.

1.2 Certain rods and wires specified in this standard are not suitable for use with particular shielding gas. Suitability of their use with a particular shielding gas should, therefore, be ascertained from the manufacturer while purchasing.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:812-1957† shall apply.

3. SUPPLY OF MATERIAL

3.1 General requirements relating to supply filler rods and wires for inert-gas arc welding shall be as laid down in IS:1387-1967‡.

4. DIMENSIONS AND TOLERANCES

4.1 The diameters of rods and wires shall be as specified in Table 1. The tolerances appropriate to the specified diameters are also given.

NOTE — The preferred sizes are given in parenthesis.

*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to welding and cutting of metals.

‡General requirements for the supply of metallurgical materials (*first revision*).

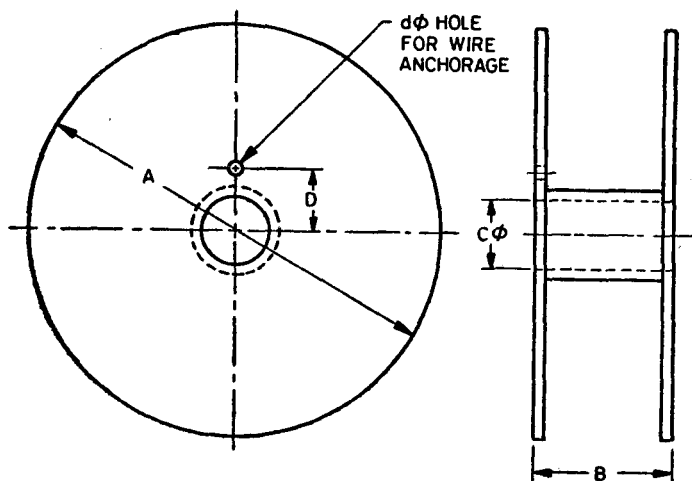
TABLE 1 DIAMETERS AND TOLERANCES

(Clause 4.1)

FORM	DIAMETER	TOLERANCE	
		Plus	Minus
	mm	mm	mm
Wire	(0.5)	0.01	0.03
	0.6		
	(0.8)		
	0.9		
	1.0		
Wire and Rod	(1.2)	0.01	0.04
	(1.6)		
	(2.0)		
	2.4		
	2.5		
Rod	(3.2)	0.01	0.07
	4.0		
	5.0		

5. REELS FOR WIRE

5.1 The size and type of reel (spool, flanged and coiled formers) on which the particular diameter of wire is to be supplied shall be as agreed to between the purchaser and the manufacturer, and shall conform to the appropriate dimensions and tolerances given in Table 2 read with Fig. 1, and Table 3 read with Fig. 2 and 3.

**FIG. 1 SPOOL**

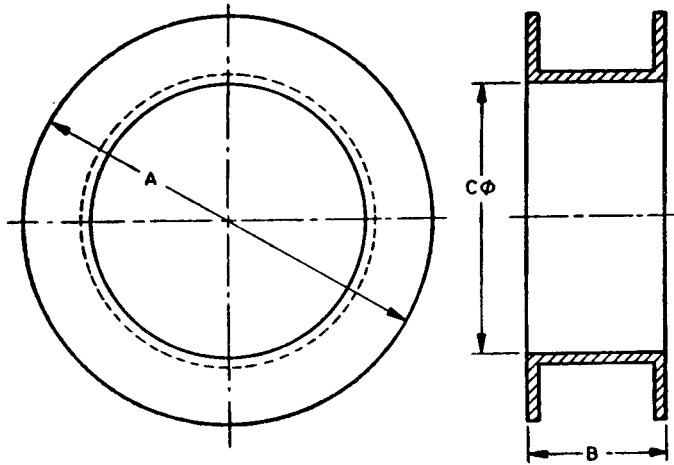


FIG. 2 FLANGED FORMER

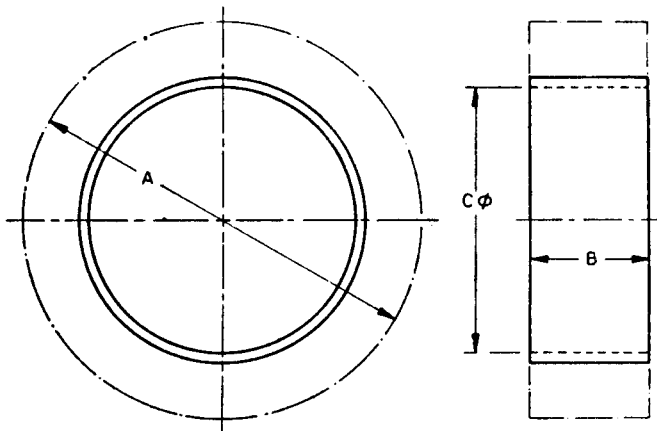


FIG. 3 COILED FORMER

5.2 The flange of spools, and flanged former shall be sufficiently robust to avoid deformation during normal usage.

NOTE — The barrel diameter for spools should be as large as possible to permit satisfactory feeding of the wire.

TABLE 2 DIMENSIONS AND TOLERANCES FOR SPOOLS

(Clause 5.1)

<i>A</i>		<i>B</i>		<i>C</i>		<i>D</i>		<i>d</i>	
Diameter of Flanges	Tolerance	Width of Spool	Tolerance	Diameter of Former	Tolerance	Distance Between Axes	Tolerance	Diameter	Tolerance
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
100	± 2	45	$\begin{smallmatrix} + 0 \\ - 2 \end{smallmatrix}$	16.0	$\begin{smallmatrix} + 1.0 \\ - 0 \end{smallmatrix}$	—	—	—	—
300	± 5	103	$\begin{smallmatrix} + 0 \\ - 3 \end{smallmatrix}$	50.5	$\begin{smallmatrix} + 2.5 \\ - 0 \end{smallmatrix}$	44.5	± 0.5	10	$\begin{smallmatrix} + 1 \\ - 0 \end{smallmatrix}$
350	± 5	103	$\begin{smallmatrix} + 0 \\ - 3 \end{smallmatrix}$	50.5	$\begin{smallmatrix} + 2.5 \\ - 0 \end{smallmatrix}$	44.5	± 0.5	10	$\begin{smallmatrix} + 1 \\ - 0 \end{smallmatrix}$
435	± 5	103	$\begin{smallmatrix} + 0 \\ - 3 \end{smallmatrix}$	50.5	$\begin{smallmatrix} + 2.5 \\ - 0 \end{smallmatrix}$	44.5	± 0.5	10	$\begin{smallmatrix} + 1 \\ - 0 \end{smallmatrix}$

TABLE 3 DIMENSIONS AND TOLERANCES OF FLANGED AND COILED FORMERS

(Clause 5.1)

<i>A</i>		<i>B</i>		<i>C</i>	
Diameter of Rim	Tolerance	Width of Rim	Tolerance	Diameter of Former	Tolerance
mm	mm	mm	mm	mm	mm
300	± 5	90	+ 0	200	+ 10 - 0
		120	+ 0 - 20		
350	± 5	90	+ 0	300	+ 15 - 0
		120	+ 0 - 20		
435	± 5	90	+ 0	300	+ 15 - 0
		120	+ 0 - 20		

NOTE — For dimension *A*, the values given in this table are the preferred ones.**6. REELING CONDITIONS**

6.1 The wire shall be closely wound in layers on the reel in one continuous length and shall be free from kinks, waves, or sharp bends and shall unwind freely without restriction. The adjacent layer within a layer need not necessarily be touching.

7. LENGTHS OF RODS

7.1 Rods less than 2.5 mm in diameter shall preferably be supplied in length of 500 mm or 1 000 mm. Rods 2.5 mm and larger in diameter shall preferably be supplied in lengths of 1 000 mm. Lengths other than these two preferred lengths may be supplied by mutual agreement between the purchaser and the manufacturer.

7.2 Tolerance on length of rod shall be ± 5 mm.

8. CONDITIONS OF RODS AND WIRES

8.1 Finish — Filler rods and wires shall have a smooth finish, free from surface imperfections, corrosion products, grease, excessive oxide or other foreign matters which would adversely affect the properties of the weld or the operation of the welding equipment.

8.2 Temper and Cast of Wire — The temper and cast of wires shall be as agreed to between the purchaser and the supplier.

9. CLASSIFICATION

9.1 The filler rods and wires are classified on the basis of their chemical composition.

9.2 In a classification (for example S-Ni 2) the alphabet 'S' indicates bare solid rod or wire. The symbol 'Ni' is used to denote nickel and nickel alloy. The digit 2 used as suffix indicates the classification based on the actual chemical composition of the rod and wire.

10. CHEMICAL COMPOSITION

10.1 The chemical composition of filler rods and wires when analysed in accordance with Indian Standard chemical analysis of nickel and nickel alloys (under preparation) shall be as given in **9.3** to **9.13**.

NOTE — Until the standard is prepared, the chemical analysis shall be carried out in accordance with the method as agreed to between the purchaser and the manufacturer.

10.2 The manufacturer shall carry out analysis from each cast of the material and when required by the purchaser, shall supply a certified cast analysis of a sample from each cast.

10.2.1 If required by the purchaser, adequate quantity of rod or wire representing each cast shall be made available to perform a check analysis and ensure that the chemical composition conforms to the specified requirements.

10.3 IS Designation S-Ni 1 Nickel Filler Rods and Wires

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	93.0	—
Cobalt	—	1.00
Iron	—	1.00
Titanium	2.0	3.50
Aluminium	—	1.50
Manganese	—	1.00
Carbon	—	0.15
Silicon	—	0.75
Copper	—	0.25
Sulphur	—	0.01
Phosphorus	—	0.0
Other elements	—	0.50

10.4 IS Designation S-Ni 2 Nickel-Copper Filler Rods and Wires

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	62.0	69.0
Cobalt	—	1.00
Iron	—	2.50
Titanium	1.50	3.00
Aluminium	—	1.25
Manganese	3.0	4.0
Carbon	—	0.15
Silicon	—	1.25
Copper	Remainder	
Sulphur	—	0.015
Phosphorus	—	0.020
Other elements	—	0.50

10.5 IS Designation S-Ni 3 Nickel-Chromium Filler Rods and Wires

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	Remainder	
Cobalt	—	1.00
Chromium	18.0	21.0
Iron	—	0.5
Manganese	—	1.2
Carbon	—	0.26
Silicon	—	0.5
Copper	—	0.20

10.6 IS Designation S-Ni 4 Nickel-Chromium-Niobium Filler Rods and Wires

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	67.0	—
Chromium	18.0	22.0
Iron	—	3.0
Cobalt	—	0.10
Niobium + Tantalum	2.00	3.00
Titalum	—	0.30
Titanium	—	0.75
Manganese	2.50	3.50
Carbon	—	0.10
Silicon	—	0.50
Copper	—	0.50
Sulphur	—	0.015
Phosphorus	—	0.03

10.7 IS Designation S-Ni 5 Nickel-Chromium-Cobalt Filler Rods and Wires (Age – Hardenable)

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	Remainder	
Chromium	18.0	21.0
Cobalt	15.0	21.0
Iron	—	3.0
Titanium	1.8	3.0
Aluminium	0.8	2.0
Manganese	—	1.0
Carbon	—	0.13
Silicon	—	1.5

10.8 IS Designation S-Ni 6 Nickel-Chromium-Cobalt-Molybdenum Filler Rods and Wires (Age – Hardenable)

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	Remainder	
Chromium	16.0	20.0
Cobalt	12.0	16.0
Molybdenum	5.0	9.0
Iron	—	1.0
Titanium	1.5	3.0
Aluminium	1.7	2.5
Manganese	—	0.5
Carbon	—	0.07
Silicon	—	0.5
Copper	—	0.2
Sulphur	—	0.015
Boron	—	0.005
Zirconium	—	0.06

10.9 IS Designation S-Ni 7 Nickel-Chromium-Cobalt-Molybdenum Filler Rods and Wires (Age— Hardenable, Boron Free)

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	Remainder	
Chromium	19.0	21.0
Cobalt	19.0	21.0
Molybdenum	5.6	6.1
Iron	—	0.7
Titanium	1.9	2.4
Aluminium	0.30	0.60
Titanium + Aluminium	2.4	2.8
Manganese	0.20	0.60
Carbon	0.04	0.08
Silicon	0.10	0.40
Copper	—	0.2
Sulphur	—	0.007
Lead	—	0.002

10.10 IS Designation S-Ni 8 Nickel-Chromium-Iron Filler Rods and Wires (Age— Hardenable)

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	67.0	—
Cobalt	—	1.00
Chromium	14.0	17.0
Iron	—	8.0
Titanium	2.50	3.50
Manganese	2.00	2.75
Carbon	—	0.08
Silicon	—	0.35
Copper	—	0.50
Sulphur	—	0.015
Phosphorus	—	0.030

10.11 IS Designation S-Ni 9 Nickel-Chromium-Molybdenum-Tungsten Filler Rods and Wires

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	Remainder	
Chromium	20.5	23.0
Molybdenum	8.0	10.0
Iron	17.0	20.0
Cobalt	0.5	2.5
Manganese	—	1.0
Carbon	—	0.15
Silicon	—	1.0
Tungsten	0.2	1.0
Lead	—	0.002 5
Sulphur	—	0.03

10.12 IS Designation S-Ni 10 Nickel-Iron-Chromium-Molybdenum Filler Rods and Wires

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	33.0	46.0
Cobalt	—	1.00
Iron	Remainder	
Chromium	19.5	23.5
Molybdenum	2.50	3.40
Titanium	0.60	2.20
Aluminium	—	0.20
Manganese	—	1.0
Carbon	—	0.05
Silicon	—	0.50
Copper	1.50	3.00
Sulphur	—	0.03
Phosphorus	—	0.03
Other elements	—	0.50

10.13 IS Designation S-Ni 11 Nickel-Iron-Chromium-Molybdenum Filler Rods and Wires (Age—Hardenable)

ELEMENT	PERCENT	
	<i>Min</i>	<i>Max</i>
Nickel	42.0	45.0
Cobalt	—	1.00
Iron	Remainder	
Chromium	15.0	18.0
Molybdenum	2.5	4.0
Titanium	0.9	1.5
Aluminium	0.9	1.5
Manganese	—	0.2
Carbon	—	0.1
Silicon	—	0.3
Sulphur	—	0.015
Boron	—	0.005
Zirconium	—	0.05

11. METHOD OF SAMPLING

11.1 The location and the method of sampling shall be agreed to between the supplier and the purchaser.

11.2 The area to be sampled shall be from the combined transverse sections obtained by bundling the rods or wires after cutting into suitable lengths, or by folding. The area shall be cleaned by grinding or pickling. The sample shall be collected by milling out the area.

11.2.1 When heat treatment is required to reduce the hardness of the sample piece before machining, the annealing temperature and time shall be kept to a minimum and a suitable discard of the decarburized surface layer shall precede collection of the sample for analysis.

12. PACKING

12.1 Filler rods and reels of wire shall be suitably packed to guard against damage, contamination or deterioration during storage, transit and inspection.

13. MARKING

13.1 Each package of rods and each reel of wire shall be clearly marked with the following information:

- a) Classification coding,
- b) Name of manufacturer,
- c) Trade designation of rods and wires,
- d) Size, and
- e) Cast number/batch number.

13.2 The package or reel may also be marked with the ISI Certification Mark.

13.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.